

ABSTRACT OF THE DISCLOSURE

A method and apparatus for depositing a low dielectric constant film by reaction of an organosilicon compound and an oxidizing gas at a constant RF power level from about 10W to about 200W or a pulsed RF power level from about 20W to about 500W. Dissociation of the oxidizing gas can be increased prior to mixing with the organosilicon compound, preferably within a separate microwave chamber, to assist in controlling the carbon content of the deposited film. The oxidized organosilane or organosiloxane film has good barrier properties for use as a liner or cap layer adjacent other dielectric layers. The oxidized organosilane or organosiloxane film may also be used as an etch stop and an intermetal dielectric layer for fabricating dual damascene structures. The oxidized organosilane or organosiloxane films also provide excellent adhesion between different dielectric layers. A preferred oxidized organosilane film is produced by reaction of methylsilane, CH_3SiH_3 , dimethylsilane, $(\text{CH}_3)_2\text{SiH}_2$, or 1,1,3,3-tetramethyl-disiloxane, $(\text{CH}_3)_2\text{-SiH-O-SiH-(CH}_3)_2$, and nitrous oxide, N_2O , at a constant RF power level from about 10W to about 150W, or a pulsed RF power level from about 20W to about 250W during 10% to 30% of the duty cycle.